

## REMARKS/ARGUMENTS

Claims 1, 2, 4-14, and 17-19 are pending in the application. The Applicant hereby requests further examination and reconsideration of the application in view of the foregoing amendments and these remarks.

### Art Rejections

In paragraph 2, the Examiner rejected claims 1, 2, 5, 6, and 11 as anticipated by U.S. Patent Application Pub. No. 2002/0071392 ("Grover"). In paragraph 4, the Examiner rejected claim 7 as obvious over Grover in view of "Capacity design of Fast Path Restorable Optical Networks," *IEEE INFOCOM 2002*, p. 817-826 ("Hauser"). In paragraph 5, the Examiner rejected claim 9 as obvious over Grover in view of U.S. Patent No. 6,404,744 ("Saito").

For the following reasons, all of the pending claims are allowable over the cited references:

#### Claims 1, 2, 5-7, 9, and 11

Claim 1 recites that the network constraints include:

- 1) for each link, a set of one or more detour paths exist whose capacities sum to the working capacity of the link;
- 2) for each link, the sum of the working capacity and the restoration capacity shared by the set of one or more detour paths is, at most, a total capacity of the link; and
- 3) the working capacity of the network is maximized.

In rejecting claim 1, the Examiner states that Grover discloses the Applicant's constraint 2, namely, "for each link, the sum of the working capacity and the restoration capacity shared by the set of one or more detour paths is, at most, a total capacity of the link," citing to Grover's constraints (2) and (5), as set forth in paragraphs [0021] and [0022] of Grover. The Examiner argues that "since both constraints (2) and (5) must be met simultaneously, the combination of the two constraints ensures the claimed limitation." This conclusion is erroneous. There is a fundamental difference in the formulation in Grover and claim 1 of this patent application. The problem that is addressed in Grover is a **network design problem**. The objective of the formulation is to design a network at minimum cost. There are **no capacity constraints** in the formulation. The objective function (constraint (1)) in Grover is merely the cost of designing the network. In contrast, in claim 1 of the present application, the Applicant assumes that the network is given, and the objective is to route the traffic. Since the network is specified, in particular, since the link capacities are given, **the routing has to respect these link capacities**. It is not possible to convert a linear network design problem into one with capacities. Therefore, there is no way that combining Grover's constraints (2) and (5) can possibly yield Applicant's constraint 2.

Grover's constraint (2) is:

$$\sum_{q \in Q^r} g^{r,q} = d^r \quad \forall r \in D$$

As explained in the reference table between paragraphs [0020] and [0021] of Grover, the variable  $g^{r,q}$  represents working capacity assigned to the  $q^{\text{th}}$  eligible working route for demand pair  $r$ , and the variable  $d^r$  represents the number of demand units for O-D pair  $r$ . Therefore, Grover's constraint (2), which, according to Grover, "ensure[s] that all working demands are routed," essentially states that the working capacity for a given demand pair is equal to the demand for that pair.

Grover's constraint (5) is:

$$s_j \geq \sum_{p \in P_i} \delta_{i,j}^p \cdot f_i^p \quad \forall (i, j) \in S \times S: i \neq j$$

As explained in the reference table between paragraphs [0020] and [0021] of Grover, the variable  $s_j$  represents the number of spare capacity units placed on span  $j$ , the variable  $\delta_{i,j}^p$  has a value of 1 if the  $p^{\text{th}}$  eligible route for restoration of span  $i$  uses span  $j$  and zero otherwise, and the variable  $f_i^p$  represents the restoration flow assigned to the  $p^{\text{th}}$  eligible restoration route for span  $i$ . Therefore, Grover's constraint (5), which, according to Grover, "forces sufficient spare capacity on each span  $j$  such that the sum of the restoration paths routed over that span is met for failure of any span  $i$ ," essentially states that the number of spare capacity units placed on span  $j$  is greater than or equal to the restoration flow for the restoration of span  $i$ .

While Grover's constraint (2) ensures that working capacity for a given demand pair is equal to the demand for that pair, and Grover's constraint (5) ensures that the number of spare capacity units placed on span  $j$  is greater than or equal to the restoration flow for the restoration of span  $i$ , no combination of these two constraints can possibly yield the Applicant's constraint 2, namely, that "for each link, the sum of the working capacity and the restoration capacity shared by the set of one or more detour paths is, at most, a total capacity of the link." Indeed, there is nothing in Grover's constraints (2) and (5) to ensure that the sum of working capacity and restoration capacity of a set of detour paths does not exceed link capacity. In other words, it is possible that both of Grover's constraints 2 and 5 can be satisfied, i.e., working capacity for a given demand pair equals demand for that pair, and a given span  $j$  has sufficient spare capacity units to handle restoration flow for span  $i$ , at the same time that the sum of working capacity and restoration capacity exceeds total link capacity, because there is no constraint in Grover to prevent this.

To the contrary, equation (8) of the Applicant's specification provides an example of the Applicant's constraint 2, as follows:

$$\sum_{P: P \in P_e} f(P) + \sum_{P: P \in P_f, e \in P} f(P) \leq u_e \quad \forall f \neq e, \quad e, f \in E \quad (8)$$

This constraint states that "the working capacity on link  $e$  plus the restoration capacity that appears on link  $e$  due to failure of link  $f (f \neq e)$  is at most the capacity  $u_e$  of link  $e$ " (specification, at p. 11, lines 9-12). The Examiner states on page 11 of the office action that the "Examiner respectfully disagrees with the equating of Applicant's constraint 2 to said formula (8) because constraint 2 is with respect to both working/restoration capacities while formula (8) recites about only the restoration traffic" (emphasis in original). However, this is a misinterpretation of Applicant's equation (8), because equation (8) not only represents restoration traffic via the expression  $\sum_{P: P \in P_f, e \in P} f(P)$ , but also represents working capacity via

the expression  $\sum_{P: P \in P_e} f(P)$ . The expression  $\sum_{P: P \in P_e} f(P)$  is shown in equation (5) on page 9 of Applicant's specification as being equal to  $x_{ij}$ , which is defined as "the working capacity on link  $(i, j)$ ," and "[a]mong the paths in the set  $P_{ij}$ , those that form the detour paths for link  $(i, j)$  have their  $f(P)$  values sum to  $x_{ij}$ , as expressed in equation (5):

$$\sum_{P: P \in P_{ij}} f(P) = x_{ij}, \quad (5)"$$

(specification, at p. 9, lines 2-12).

Constraints (2) and (5) of Grover, even taken in combination, do not disclose any constraint involving a sum of both restoration traffic and working capacity, to ensure that the link capacity  $u_e$  of a link  $e$  is not exceeded, as required by claim 1. Nor do the other portions of Grover cited by the Examiner disclose such a constraint – there is simply no such constraint disclosed, taught, or even suggested in Grover. Since Grover does not disclose a network constraint wherein “for each link, the sum of the working capacity and the restoration capacity shared by the set of one or more detour paths is, at most, a total capacity of the link,” Grover cannot anticipate claim 1.

None of the other cited references teach the features of claim 1 that are missing from Grover.

For these reasons, the Applicant submits that claim 1 is allowable over the cited references. Since claims 2, 5-7, 9, and 11 depend variously from claim 1, it is further submitted that those claims are also allowable over the cited references.

In view of the foregoing, the Applicant submits that the rejections of claims under Sections 102 and 103 have been overcome.

#### Claims 4, 8, and 10

In paragraph 6, the Examiner indicated that claims 4, 8, and 10 would be allowable if rewritten in independent form.

#### Claims 12-14 and 17-19

In paragraph 7, the Examiner allowed claims 12-14 and 17-19.

In view of the above remarks, the Applicant believes that the pending claims are in condition for allowance. Therefore, the Applicant believes that the entire application is now in condition for allowance, and early and favorable action is respectfully solicited.

#### **Fees**

During the pendency of this application, the Commissioner for Patents is hereby authorized to charge payment of any filing fees for presentation of extra claims under 37 CFR 1.16 and any patent application processing fees under 37 CFR 1.17 or credit any overpayment to Mendelsohn & Associates, P.C. Deposit Account No. 50-0782.

The Commissioner for Patents is hereby authorized to treat any concurrent or future reply, requiring a petition for extension of time under 37 CFR § 1.136 for its timely submission, as incorporating a petition for extension of time for the appropriate length of time if not submitted with the reply.

Respectfully submitted,

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